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Editorial

Welcome to *Bioengineering*: A New Open-Access Journal

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It is my great pleasure to welcome you to a new open access journal, *Bioengineering*, which represents a scope that fits squarely with the core expertise and growing ambitions and interests of bioengineers globally. Of particular interest are the transdisciplinary and translational research represented by the activities within centers and institutes where the biological sciences and engineering disciplines cohabit seamlessly for a focus on solutions to global challenges in human, veterinary and ecological health, bioenergy, bioprocess and sustainability. *Bioengineering* emphasizes the publication of novel and high quality peer reviewed articles via an open access platform. The scope includes:

- Bionics and biological cybernetics: implantology; bio–abio interfaces.
- Bioelectronics: wearable electronics; implantable electronics; “more than Moore” electronics; bioelectronics devices.
- Bioprocess and biosystems engineering and applications: bioprocess design; biocatalysis; bioseparation and bioreactors; bioinformatics; bioenergy; *etc*.
- Biomolecular, cellular and tissue engineering and applications: tissue engineering; chromosome engineering; embryo engineering; cellular, molecular and synthetic biology; metabolic engineering; bio-nanotechnology; micro/nano technologies; genetic engineering; transgenic technology.
- Biomedical engineering and applications: biomechatronics; biomedical electronics; biomechanics; biomaterials; biomimetics; biomedical diagnostics; biomedical therapy; biomedical devices; sensors and circuits; biomedical imaging and medical information systems; implants and regenerative medicine; neurotechnology; clinical engineering; rehabilitation engineering.
- Biochemical engineering and applications: metabolic pathway engineering; modeling and simulation.
- Translational bioengineering.

Bioengineering, the discipline, emerged as a leading branch among engineering disciplines in the early 21st Century, providing a rich field of study with potential for high impact because of its transformative and translational focus. Bioengineering is the ultimate contraction of Bio*X* engineering, including bio*logical* engineering, bio*medical* engineering and bio*molecular* engineering. Each of these subfields has exploded in interest and participation because of their considerable transformative impact. The 2013 survey of jobs conducted by CNNMoney finds; based on 2010–2020 job growth estimates, median pay for experienced workers, the size of the field and overall job satisfaction, that Biomedical Engineering was found to be the No. 1 job in the United States [1]. As we embrace major national initiatives such as "Future Health" in Singapore [2], "The BRAIN Initiative" in the USA [3], or "U.S. President's Emergency Plan for AIDS Relief " in South Africa, we find that central to many of these grand challenge campaigns is the field of bioengineering. *Bioengineering*, the journal, will serve as an advanced forum for the most impactful of the developments in the science, engineering and technology related to biology and the life sciences broadly.

Bioengineering publishes critical reviews, regular original research papers and short communications. In addition, we are introducing a new concept in scientific and technical publications—"The Translational Case Report in Bioengineering". The translational case report in bioengineering is a descriptive explanatory analysis of a transformative or translational event or process. Understanding that the goal of bioengineering scholarship and practice is to advance towards a transformative or clinical solution to an identified transformative/clinical need, the translational case report is used to explore causation in order to find underlying principles that may guide other similar transformative/ translational undertakings. Case reports are generally retrospective in nature. For example, suitable topics may be: (i) The development and commercialization of a particular technology that is based on bioengineering principles. (ii) Tissue engineering: the early days (an historical look at the emergence of tissue engineering and regenerative medicine as a viable clinical solution). The translational case report may explore the intersection of bioengineering science and engineering with Institutional Review Boards (IRB) and Technology Transfer policies and practices, public and private sector commercial development entities, *etc*. Central to the Translational Case Report in bioengineering is a scholarly treatment, which, subject to peer-review, is worthy of publication in this world class journal.

The future of *Bioengineering* is inextricably linked to the future of bioengineering the discipline. Where then are the quantum technical challenges for our discipline? Here are three areas that are of unapologetic interest to this bioengineer. Firstly, the impact of natural disasters, such as the 2013 super-typhoon Haiyan that ravaged the central Philippines [4], the 2011 Tōhoku earthquake, tsunami and associated Fukushima Daiichi nuclear disaster, the 2010 Gansu mudslide of NW China, and the 2010 earthquake and subsequent cholera outbreak that has devastated Haiti, are among a class of local challenges felt globally that will become increasingly commonplace. Such disasters appear commonplace not because they occur more frequently but because their impact is felt globally through the vast numbers of affected lives and economic cost; the result of population growth and regional population concentration [5]. While reports generally focus on the numbers of persons who perish in these disasters, we learn less about the numbers of persons who could otherwise have survived but nonetheless perished from traumatic injuries sustained during the disaster. Bioengineers must enable new technologies to enable life saving measures to victims of trauma; better triage decision making, better distribution of care enabled by rapidly deployable physiological status measurement and communications technologies to enable better management of outcomes. Secondly, these natural disasters reveal the need for global systems thinking. While cholera, brought to Haiti during the humanitarian relief effort continues to ravage that country, the response of the international aid community has been to provide medications and physicians to address what is but a symptom. The unavailability of clean water through a proper water distribution infrastructure is likely causative for the three-year prolonged battle with cholera [6].

Secondly, there is need for a global push for improved quality and availability of low cost diagnostics to address the challenges faced by many in low to middle income countries [7]. Engineers are all too familiar with the old truism, "you cannot control that which you cannot measure". To change the trajectory of communicable and non-communicable diseases globally, we will need to engender tools, techniques and technologies for the rapid screening and subsequent accurate quantitation of biomarkers of diseases. All of this must be done under financially and infrastructurally austere conditions. There is every indication that the world's bioengineers are responding to this challenge. The Grand Challenge of the Gates Foundation is also a challenge for bioengineers to think globally.

Finally, we must leverage that which we have done so successfully outside the body, namely the miniaturization of advanced computational capabilities and its seamless melding with communication technologies, to the advantage of what we must now do on the inside of the body. The development of advanced cochlea implants, intra-ocular prostheses, and advanced brain machine interfaces are but stepping stones towards implantable bioelectronic devices, indwelling bioenergy sources, fully integrated implantable microsystems for bioanalytical measurements of physiological status, and brain machine interfacing [8]. No success is possible unless we comprehensively address the management of the abio–bio interface [9]. Success in these areas is on a critical path to an eventual manned exploration and eventual colonization of Mars. The pending commercialization of space and the public–private partnership spawned by financial constraints at our national space agencies heralds in a new thinking about our next manned efforts beyond the International Space Station. Bioengineering for planetary exploration promises to be one of three quantum technical challenges that will drive the future of our field.

The opportunities are manifold. Any other bioengineer may suggest an equally persuasive alternative three quantum technical challenges. The one thing we will all agree upon is the need for new approaches in the preparation of next-generation bioengineers. Young engineers are drawn to bioengineering because of the clear path it presents to an engagement with "changes to practice". The high degree of job satisfaction referenced earlier is derived in large part from this aspect. Yet, we pursue the preparation of bioengineers in much the same manner as we prepare other engineers. Thanks to the Whitaker Foundation (1975–2006) we have seen a proliferation of Biomedical Engineering departments in the USA and thanks to the Coulter Foundation's *Translational Research* Award mechanism we have seen these oriented towards translational opportunities. Further experiments are afoot. The Johns Hopkins University Center for Bioengineering Innovation and Design focuses student's attention on problems and then challenges them to innovate. The development of an advanced degree in Future Health within an Interdisciplinary Graduate School at Nanyang Technological University that simultaneously trains bioengineers alongside physicians, and the embedding of students in the clinical stage of the product development life cycle at the Clemson Bioengineering Innovation Campus (CUBEInc) are examples that serve to immerse the student-apprentice in the practice, providing motivation and enriching context for study. In this sense bioengineering education is continuing to evolve. As part of its evolution, bioengineering could itself benefit from the equivalent of the Grand Challenge Scholars Program (GCSP), now endorsed by both the U.S. National Academy of Engineering and the UK's Royal Academy of Engineering, that seeks to engage multidisciplinary graduate learning in the context of the 14 Grand Challenge goals believed to hold the potential to dramatically improve life in the 21st century.

We hope that you will share our enthusiasm for this new journal and look forward to working with you to make it a leader in its field.

Conflicts of Interest

The author declares no conflict of interest.

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